

## **Chapter 3. Description of the Fishery**

### **3.1 Areas and Stocks Involved**

Market squid have a wide distribution throughout the California and Alaska current systems from the southern tip of Baja California, Mexico (23° N latitude) to southeastern Alaska (55° N latitude, Dickerson and Leos 1992). Although the major fisheries are in central and southern California, short-term fisheries have developed along the coast from central California to British Columbia and southeast Alaska (CDFG 2001). Market squid are pelagic invertebrates and have been found at depths to 2600 feet. Squid are commercially harvested during spawning events that occur at depths of 50 to 150 feet. Commercial fishermen target spawning aggregations of squid; spawning grounds are typically nearshore areas (less than 600 feet depth) over sandy bottom habitat where egg cases are deposited.

There are two major fishery areas in California; Point Conception divides the northern and southern fisheries. The northern fishery is centered on Monterey Bay and squid is landed at Monterey and Moss Landing. the northern fishery operates predominately within a half-mile of the Monterey Bay shoreline. The southern fishery targets a multitude of fishing spots including the Channel Islands and the coastal area from Point Conception south to La Jolla. Squid are landed at the ports of Ventura, Port Hueneme, San Pedro and Terminal.

Genetic analysis has been successful in distinguishing stocks within a fishery. Gilly et al. (1999) investigated genetic differences between the northern and southern fisheries. While they found no temporal or spatial genetic differences for market squid within the Southern California Bight and no temporal differences occurred between samples in the Monterey areas, their studies suggest that there is some genetic difference between the Monterey and southern California squid taken in the fishery.

### **3.2 History of Exploitation**

Market squid are important to both commercial and recreational fisheries. The commercial fishery has a long history in California, dating back to the mid-nineteenth century, although catches were usually less than 10,000 tons until the 1960's (Table 3-1). During the 1980's, California's squid fishery grew rapidly in fleet size and landings when international demand for squid increased

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due to declining squid fisheries in other parts of the world (CDFG 2001). In 1997, the rapid growth of fleet size was halted by a moratorium on new permits.

Table 3-1. Historical market squid landings in tons for California divided at Point Conception into northern and southern fisheries.			
Season*	Northern fishery	Southern fishery	Total landings
1927-1928	34	0	34
1928-1929	686	44	730
1929-1930	2,303	16	2,319
1930-1931	5,494	16	5,510
1931-1932	792	71	863
1932-1933	2,072	28	2,100
1933-1934	430	4	434
1934-1935	736	19	755
1935-1936	329	19	347
1936-1937	451	17	469
1937-1938	245	61	306
1938-1939	754	11	765
1939-1940	522	53	575
1940-1941	818	86	904
1941-1942	694	47	741
1942-1943	406	34	440
1943-1944	4,529	18	4,546
1944-1945	5,435	38	5,472
1945-1946	7,586	27	7,613
1946-1947	19,777	18	19,795
1947-1948	8,728	64	8,792
1948-1949	7,599	59	7,658
1949-1950	3,087	2	3,089
1950-1951	2,997	2	2,999
1951-1952	5,844	374	6,219
1952-1953	1,746	2,649	4,394
1953-1954	2,076	391	2,467
1954-1955	3,772	77	3,849
1955-1956	6,714	119	6,833
1956-1957	9,828	478	10,306
1957-1958	5,496	1,753	7,249
1958-1959	1,902	2,848	4,750
1959-1960	7,140	94	7,235
1960-1961	1,103	996	2,099
1961-1962	1,987	4,075	6,062
1962-1963	2,886	2,028	4,914
1963-1964	3,174	1,641	4,815
1964-1965	4,551	5,223	9,774
1965-1966	4,439	4,508	8,947
1966-1967	5,597	4,211	9,808
1967-1968	5,617	6,088	11,705

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Table 3-1. Historical market squid landings in tons for California divided at Point Conception into northern and southern fisheries.			
Season*	Northern fishery	Southern fishery	Total landings
1968-1969	7,289	2,668	9,957
1969-1970	5,780	6,186	11,966
1970-1971	4,314	8,861	13,175
1971-1972	8,328	4,475	12,803
1972-1973	6,124	5,057	11,181
1973-1974	621	7,696	8,317
1974-1975	7,248	5,302	12,549
1975-1976	2,495	10,563	13,058
1976-1977	2,511	6,587	9,098
1977-1978	2,235	12,050	14,285
1978-1979	10,343	8,680	19,024
1979-1980	14,169	7,213	21,381
1980-1981	7,860	12,087	19,947
1981-1982	14,132	11,700	25,833
1982-1983	11,697	1,516	13,213
1983-1984	1,061	27	1,087
1984-1985	549	804	1,354
1985-1986	4,276	10,100	14,376
1986-1987	6,967	18,636	25,603
1987-1988	6,632	18,582	25,214
1988-1989	5,765	42,430	48,195
1989-1990	7,829	25,222	33,051
1990-1991	8,871	23,602	32,472
1991-1992	9,013	29,653	38,666
1992-1993	9,450	9,343	18,793
1993-1994	10,012	44,440	54,452
1994-1995	19,103	44,489	63,592
1995-1996	3,676	90,157	93,833
1996-1997	5,828	118,481	124,309
1997-1998	9,275	1,623	10,898
1998-1999	26	11,673	11,699
1999-2000	308	126,464	126,772
2000-2001	7,730	115,670	123,401

\*1 April thru 31 March

Although it is not known when recreational fisheries in California started to use market squid as bait, it is used as either live or dead bait for recreational fisheries throughout the state. It is believed that squid taken for the recreational fishery is a mere fraction of what the commercial fishery lands annually, but this has not been quantified.

### **3.2.1 Description of User Groups**

#### **3.2.1.1 Commercial Fishery**

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California's market squid fishery began in 1863, as Chinese immigrants harvested small quantities of squid from Monterey Bay (Dickerson and Leos 1992). Two skiffs encircled a net around another skiff that used a torch to attract the squid to the surface. The product was dried and exported to China. In 1905, Italian immigrant fishermen introduced the more efficient lampara net. The lampara net (Table 3-2) was the only legal form of round haul gear in the southern bight of Monterey Bay until 1989. Once purse and drum seines were legalized, the squid fleet switched gear types and the lampara became obsolete. In Districts 16 and 17, attracting lights were prohibited between 1959 and 1988; in 1989 lights were again allowed in the northern fishery. Catch in the northern fishery has not expanded in terms of volume and location and the number of vessels participating has declined over time (Table 3-1).

Table 3-2. Description of gear types.

Lampara	A round haul net, where one end is anchored or attached to a skiff and the deploying vessel will encircle the squid with the net. The "wings" of the net are pulled back to the boat and the squid end up in the bag portion of the net.
Purse seine	A round haul net with a "purse" line to close the bottom of the net. One end is attached to a skiff and the deploying vessel encircles the squid. The other end of the net is brought to the deploying vessel and the purse line is drawn, closing the bottom of the net to prevent escaping squid.
Drum seine	Like a purse seine, but a large drum stores, deploys, and retrieves the net.
Brail	A large dip net, sometimes used with the assistance of the vessel's hydraulics.

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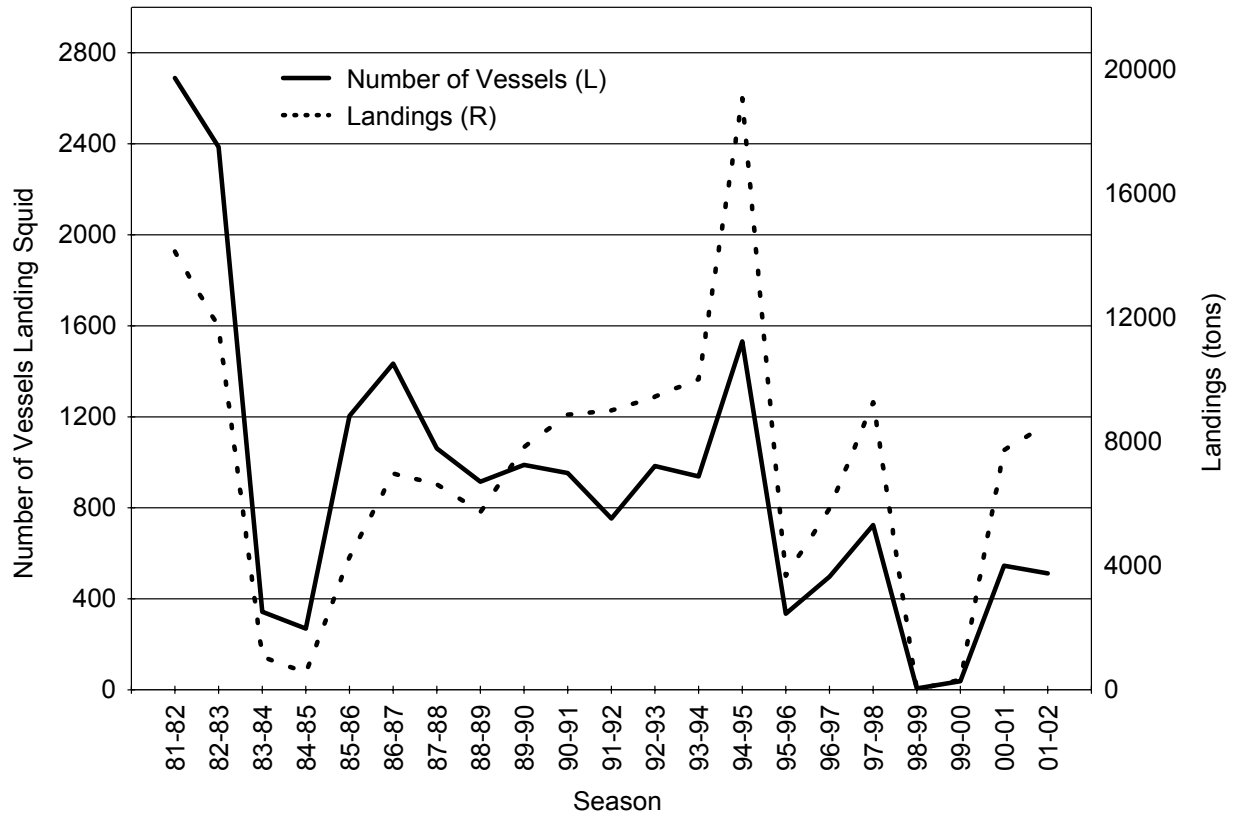


Figure 3-1. Number of vessels and market squid landings by season for Northern California.

During the 1970's, scoop boats, using a power-assisted brail or dip net in conjunction with attracting lights, were the major harvesters in the southern California squid fishery (Kato and Hardwick 1975). In 1977, the fleet shifted from using brail vessels to purse seine vessels (Vojkovich 1998). Brail vessels still land a small portion of the catch (less than 2.0% in 2000-2001 season) – they have the advantage of fishing in some areas which are closed to roundhaul gear, and can land smaller volumes at a higher value – but purse seine and drum seine vessels have proven to be more effective at landing large volumes of squid. By the early 1990s, the purse seine became the dominant gear on the entire coast, with the drum seine gaining popularity by the mid-1990's (Tables 3-3 and 3-4).

Table 3-3. Seasonal landings in short tons by gear type recorded on commercial landings receipts.(note: "Other" includes, but is not limited to jig, hook and line, trawl nets, dip nets, and other roundhaul nets).						
Season	Brail	Purse seine	Drum seine	Lampara	Other	Total
1981-1982	7671	3,819	0	11,880	2,463	25,833
1982-1983	690	968	0	11,474	81	13,213
1983-1984	20	3	0	380	684	1,087
1984-1985	572	45	0	139	598	1,354

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Table 3-3. Seasonal landings in short tons by gear type recorded on commercial landings receipts. (note: "Other" includes, but is not limited to jig, hook and line, trawl nets, dip nets, and other roundhaul nets).

Season	Brail	Purse seine	Drum seine	Lampara	Other	Total
1985-1986	53	8,875	0	2,133	3,315	14,376
1986-1987	263	15,678	0	3,810	5,852	25,603
1987-1988	152	16,186	0	3,755	5,121	25,214
1988-1989	146	35,684	55	4,631	7,679	48,195
1989-1990	105	25,394	322	1,397	5,833	33,051
1990-1991	102	25,855	0	851	5,664	32,472
1991-1992	44	32,212	19	62	6,329	38,666
1992-1993	18	17,013	0	109	1,653	18,793
1993-1994	384	45,668	6,422	6	1,972	54,452
1994-1995	1,259	44,123	16,158	45	2,007	63,592
1995-1996	969	62,761	29,323	170	610	93,833
1996-1997	367	90,817	32,146	97	882	124,309
1997-1998	18	7,911	2,948	0	21	10,898
1998-1999	192	8,177	3,326	0	4	11,699
1999-2000	1,141	95,428	29,914	71	218	126,772
2000-2001	2,286	92,782	27,997	68	267	123,400

Table 3-4. Percent of landings by season and gear type (note: "Other" includes, but is not limited to jig, hook and line, trawl nets, dip nets, and other roundhaul nets).

Season	Brail	Purse seine	Drum seine	Lampara	Other
1981-1982	17.3	4.2	0.0	61.3	17.2
1982-1983	4.2	2.6	0.0	86.0	7.2
1983-1984	1.4	0.7	0.0	24.1	73.8
1984-1985	26.4	2.1	0.0	7.9	63.5
1985-1986	1.6	23.0	0.0	36.0	39.4
1986-1987	1.5	24.7	0.0	33.9	39.9
1987-1988	1.3	34.8	0.0	29.3	34.5
1988-1989	1.3	46.6	0.3	25.0	26.7
1989-1990	1.2	53.2	2.1	10.6	32.9
1990-1991	0.8	67.5	0.0	2.4	29.4
1991-1992	0.4	77.3	0.1	1.1	21.2
1992-1993	0.5	77.0	0.0	2.7	19.7
1993-1994	3.3	77.3	10.3	0.3	8.8
1994-1995	5.4	65.8	25.2	0.2	3.4
1995-1996	5.0	54.7	38.6	0.4	1.3
1996-1997	1.6	65.1	31.9	0.2	1.1
1997-1998	1.1	55.6	29.5	0.0	13.9
1998-1999	6.5	60.4	23.1	0.0	10.0
1999-2000	3.8	72.1	22.0	0.1	1.9
2000-2001	7.3	65.6	23.5	0.6	3.0

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According to Department records, the average purse seine vessel length is 62 feet, but the most common length is 58 feet. The average hold capacity is 84 short tons. At present, the majority (67%) of the fleet uses a purse seine, 27% a drum seine, and 6% lampara nets. The average net is 1250 feet long with a depth of 156 feet. The stretched mesh size is one inch. Nearly all vessels use side-scan sonar and fathometers. The average vessel power is 428 HP and auxiliary power is 148 HP. Most vessels (82%) use refrigerated seawater to keep their catch cold, while others (live bait vessels) use circulated seawater, brine, or no cooling system at all.

In most cases, squid seiners work with light boats. A light boat is typically a smaller vessel with several high-powered lights located at various levels around the vessel. The purpose of the lights is to attract and aggregate spawning squid to surface waters. The light boat actively searches for squid. When squid are located, the light boat will signal the seiner to deploy its net, encircling the light boat, in order to catch the squid. Anecdotal information suggests the light boat gets 20% of the ex-vessel value of the catch (CDFG 2001).

According to logbook records, the average light boat is 39 feet in length with a gross tonnage of 19 short tons. Wattage for squid attracting lights averages approximately 22,500 watts (30,000 watts is the legal maximum). Nearly all light boats use side-scan sonar and fathometers. Light boat power and auxiliary power average 379 HP and 63 HP, respectively.

Prior to the 1998-1999 season, the squid fishery was largely unregulated; no special permit was required to harvest squid. This created an influx of fishing vessels from other states where other fisheries were declining. Squid supplemented the income of many vessels from southern California that also participate in the tuna and CPS fisheries. Many vessels in the southern fishery have homeports in the states of Alaska, Washington, and Oregon and participate in the Alaska and Washington salmon fisheries. In recent years, some vessels from the squid fishery participated in a high value sardine fishery off the Columbia River at the border of Oregon and Washington. Many light boats also participate in other local fisheries such as herring, hook-and-line and gillnet. Some fishermen have complained about user conflict and territorial disputes between "local" and out-of-state fishermen.

Landings of up to two tons can be made by non-permitted vessels – vessels in other fisheries, such as trawlers, that periodically catch small volumes of squid. Non-permitted vessels land only incidental amounts in terms of both volume and number (Table 3-5).

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Table 3-5. Historical California landing receipt information for permitted and non-permitted vessels, 1981-1982 to 2000-2001. Vessels fishing for squid were not required to have a squid fishing permit until the 1998-1999 season; this table shows the historical activity by the vessels currently permitted as of the 2000-2001 squid fishing season.							
Season	Landings (tons)	Landings (tons) by current permittees	Percent landings made by permittees	Number of active vessels	Number of currently permitted active vessels	Number of landings	Number of landings by permitted vessels
1981-1982	25,833	11,555	44.7	150	32	3,569	1,621
1982-1983	13,213	7,204	54.5	124	27	2,718	1,277
1983-1984	1,087	741	68.2	80	17	421	170
1984-1985	1,354	479	35.4	94	22	466	176
1985-1986	14,376	9,472	65.9	124	37	1,757	985
1986-1987	25,603	20,245	79.1	121	39	2,399	1,662
1987-1988	25,214	20,892	82.9	116	38	1,936	1,428
1988-1989	48,195	36,419	75.6	118	46	2,592	1,795
1989-1990	33,051	24,702	74.7	99	42	2,036	1,417
1990-1991	32,472	27,660	85.2	99	43	1,825	1,476
1991-1992	38,666	34,395	89.0	84	44	1,731	1,502
1992-1993	18,793	16,866	89.7	82	41	1,394	1,143
1993-1994	54,452	49,254	90.5	92	49	2,701	2,333
1994-1995	63,592	58,176	91.5	109	60	3,485	3,070
1995-1996	93,833	88,066	93.9	125	74	4,124	3,720
1996-1997	124,309	114,818	92.4	142	89	5,078	4,531
1997-1998	10,898	10,744	98.6	86	50	909	778
1998-1999	11,699	11,363	97.1	115	83	1,344	1,152
1999-2000	126,772	123,191	97.2	167	107	4,718	4,486
2000-2001	123,400	120,390	97.6	154	108	4,343	4,081

The number of businesses purchasing squid has remained constant since the early 1980's (Table 3-6). The majority of these businesses purchased less than 100 short tons per year, most of which was probably bycatch of squid from other fisheries.



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Table 3-6. Number of fish businesses receiving market squid, 1981-82 to 2000-01.			
Season	Businesses receiving 100 tons or less seasonally	Businesses receiving more than 100 tons seasonally	Total number of businesses
1981-1982	22	39	61
1982-1983	14	38	52
1983-1984	4	47	51
1984-1985	5	48	53
1985-1986	16	44	60
1986-1987	20	48	68
1987-1988	19	49	68
1988-1989	28	58	86
1989-1990	20	37	57
1990-1991	16	39	55
1991-1992	15	26	41
1992-1993	11	30	41
1993-1994	17	25	42
1994-1995	19	33	52
1995-1996	14	27	41
1996-1997	17	27	44
1997-1998	9	33	42
1998-1999	10	41	51
1999-2000	17	37	54
2000-2001	17	43	60

### **3.2.1.2 Recreational Fishery**

The other major user group is the recreational fishery. Market squid are primarily caught by bait haulers using seine, lampara, or brail nets. This small volume of squid is a high value fishery which supplies bait in-season to recreational fisheries along the California coast, primarily in southern California (CDFG 2001). Live bait is sold from the catcher vessel at sea, or from one of the many harbor-based bait dealerships. Many sport fishing vessels and privately owned skiffs catch their own squid bait by using attracting lights and brail nets, crowder nets, and/or rod and reel. Live and dead squid are ideal bait for a variety of California sport fisheries, especially rockfish and white seabass. The quantity of squid taken as live bait is not documented, but it is believed to be minimal compared to the commercial harvest.

### **3.2.2 Fishing Effort**

#### **3.2.2.1 Commercial Fishing Effort**

Market squid is one of the largest commercial fisheries in California in terms of landing volume and ex-vessel value. In the 1990's, the market squid fishery ranked highest among the state's fisheries: squid ranked number one in landings for six years and the number one for dollars paid ex-vessel for three years (CDFG 2001). Although quite successful, the commercial squid fishery is unpredictable due to environmental (El Niño) and market conditions.

During an El Niño period (i.e., 1997-98), squid availability drops along with fishing effort and catch. In years when squid are readily available, fishing effort is reflective of market conditions. During the late fall and early winter for the southern fishery, summer for the northern fishery, (Fig. 3-2) vessel participation is at its highest point. This may create excess supply that is reflected in the market. When squid processors have full freezers or the demand for California squid is low, vessels are generally put on market-imposed limits and ex-vessel prices may be lowered. As the season progresses, many vessels leave for other fisheries. The vessels that remain in the squid fishery often get to take advantage of higher or no trip limits and increased ex-vessel prices. When ex-vessel prices drop too low, effort may also drop because of less economic incentive to fish.

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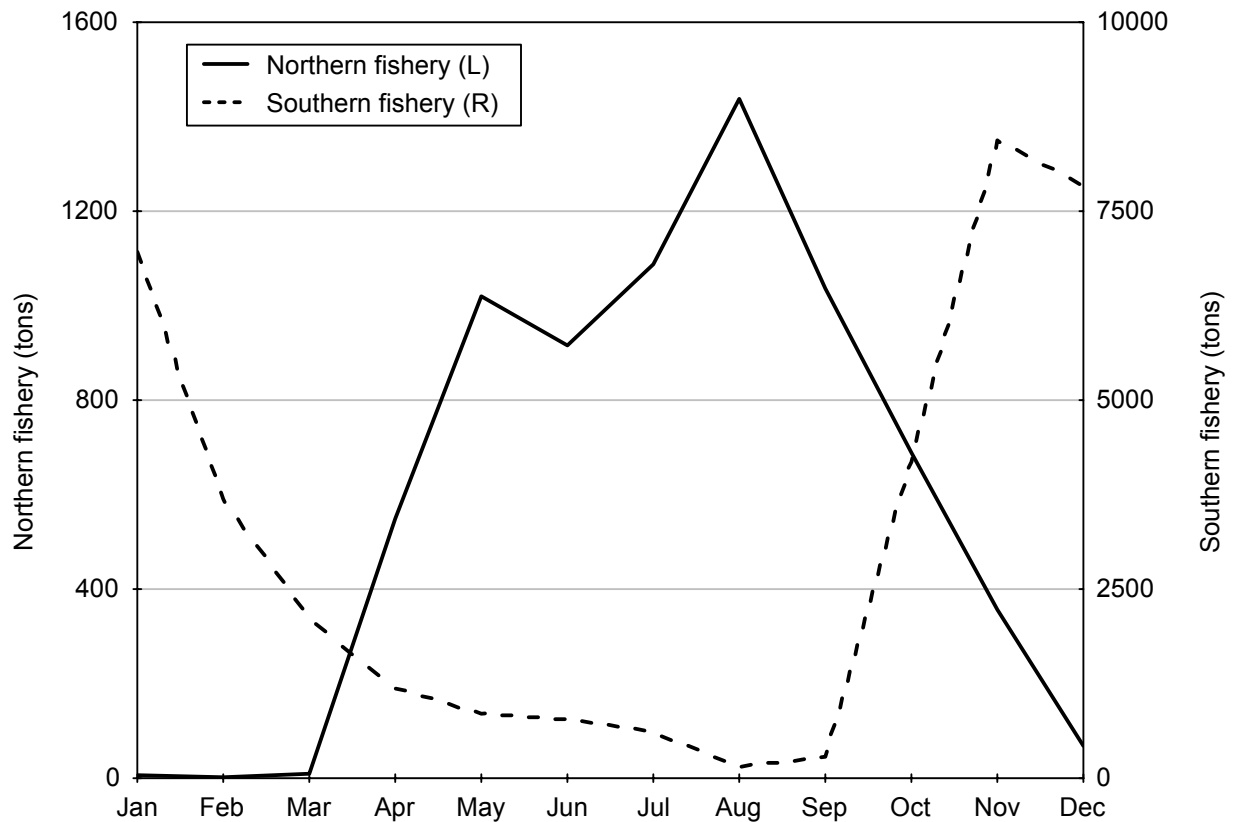


Figure 3-2. Average monthly landings in tons for the squid fishery divided at Point Conception into northern and southern fisheries for the period of 1981 through 2001.

Although market squid may be available in commercial quantities from Baja California to Oregon, the fishery is centered in two areas of California: Monterey Bay and the Channel Islands off southern California. The earliest fishery, in Monterey Bay, caught less than 1,000 tons per year from 1916 to 1923 (Dickerson and Leos 1992). From 1924 to 1932, landings averaged more than 2,000 tons per year. Most of this catch was dried and exported to China; some was used domestically as canned or frozen product. The Asian market closed in 1933 due to financial conditions and the domestic market supported the Monterey fishery for many years. Landings in California were minimal until 1942 when demand from international aid programs triggered a rise in the need for squid the following year. Landings peaked at close to 20,000 tons in the 1946-1947 season, then averaged 9,100 tons until the 1981-1982 season when greater than 25,000 tons were landed (Table 3-1). Prior to the 1960's, the majority of squid landings were in the Monterey Bay area. In 1961, the fishery in southern California experienced a dramatic increase in landings. The southern fishery centered on the Channel Islands, and landed squid in Santa Barbara and Ventura counties. This fishery eventually expanded to Santa Catalina Island and to coastal nearshore areas (Hill and Yaremko 1997) (Fig. 3-3).

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After the 1960s, the southern squid fishery showed a marked expansion; since the early 1980s, landings in southern California have exceeded those of the northern fishery (Fig. 3-3; also see Table 3-1). Fishery landings reached a peak of 126,772 short tons in the 1999-2000 season. The rapid fishery expansion of the last 25 years is a result of rising demand for squid in foreign markets, especially Europe and China.

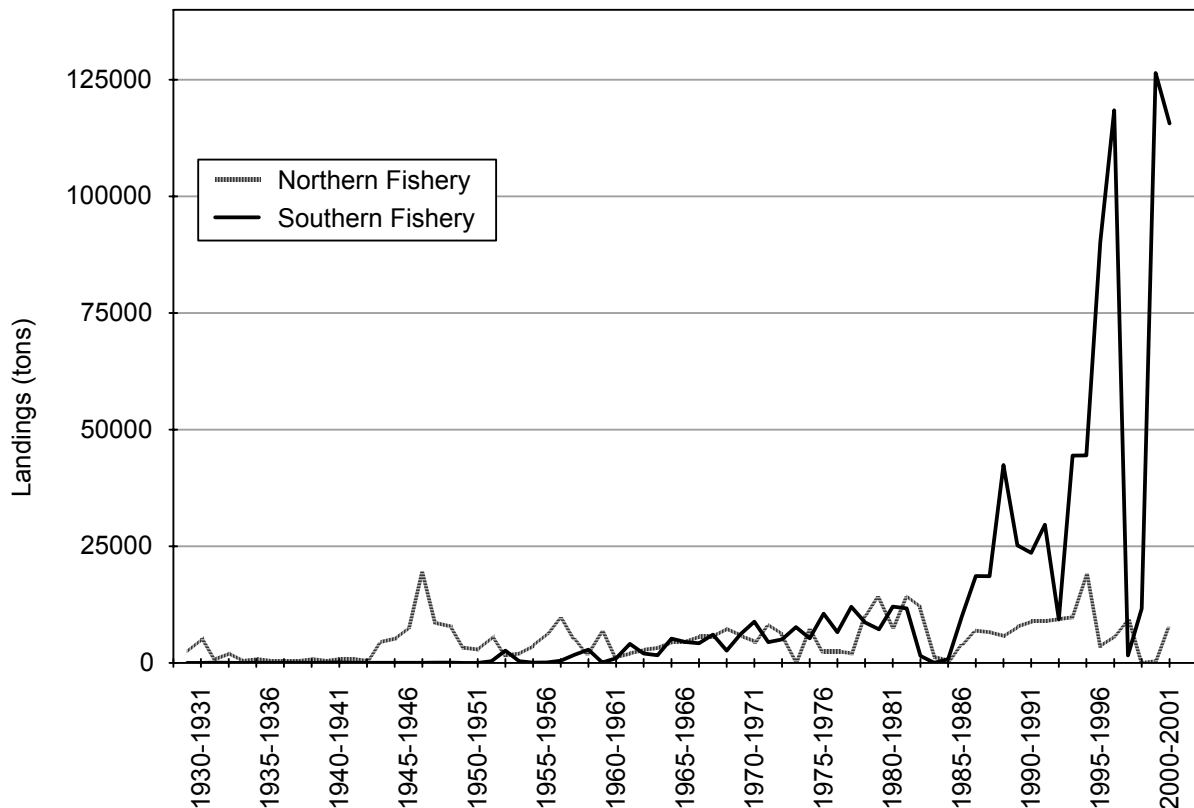


Figure 3-3. Market squid landings from 1927/1928 through 2000/2001 seasons showing the increase in landings for the fishery south of Point Conception.

Prior to April 1998, the squid fishery was largely an unregulated, open-access fishery. Because of the dramatic increases in recent statewide landings, the State enacted legislation to ensure the sustainability of the squid fishery and resource. This legislation required the purchase of an annual permit for three years either to land more than two short tons per trip, or to attract squid by using light for purposes of commercial squid harvest. Eligibility was determined by the purchase of a permit from the previous year. In the 2000-01 season there were 195 vessel permits and 50 light boat permits issued. Since the moratorium period, the number of vessel and light boat permits has declined (Table 3-7, CDFG 2001).

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Table 3-7. Vessel and light boat permit issuances, 1998-99 to 2000-01 seasons.				
Season	Vessel permits issued	Vessel attrition(%)	Light boat permits issued	Light boat attrition (%)
1998-1999	248	--	53	--
1999-2000	218	12.1	51	3.8
2000-2001	195	9.6	50	2.0

Not all permitted vessels were active in the fishery during the moratorium period. Many purchased permits could not find viable markets. Despite the large number of permits issued, the current squid fleet consists of approximately 60 dedicated seiners. As with many fisheries, a select number of vessels made the majority of the catch. In the 1998-99, 1999-2000, and 2000-01 seasons 26, 37, and 24 permitted vessels, respectively, made 75% of the catch.

### **3.2.2.2 Recreational Fishing Effort**

There are insufficient data to describe recreational fishing effort for market squid. Voluntary live bait logs do not report squid catch. Some light boat operators record scooping live squid for bait in their logbooks. The amount of bait is usually minor compared to the commercial catch. For the 2000-01 season, light boat logbook data show a live bait catch of nine short tons. Preliminary data for the 2001-02 season show a live bait catch of 49 short tons. Again, these data are voluntary and can only be considered as a minimum amount of squid harvested for bait.

## **3.3 Social and Economic Characteristics of the Fishery**

### **3.3.1 Commercial Sector Socioeconomics**

The California market squid is the most valuable commercial fishery product to the state in terms of volume and revenue, generating upward of \$35 million ex-vessel revenue in recent years. Among California fishery exports in 2000, market squid ranked first by volume and value; further, market squid has ranked first in both volume and revenue several times during the 1990s (Table 3-8). The vast majority of squid is frozen for export to China, Japan and Europe where it is used mainly for human consumption. Minor amounts are sold fresh or canned.

Table 3-8. Market squid volume and value exported and respective rankings for 1990 through 2000 (last year data available).					
Year	Squid exported (tons)	Export value*	Rank by volume	Rank by value	Percent catch exported
1989	5,267	\$5,667,283	1	7	11.7
1990	4,571	\$4,110,021	2	10	14.6
1991	2,619	\$2,637,344	12	20	6.4
1992	4,187	\$3,938,031	2	8	29.0

**PRELIMINARY DRAFT MARKET SQUID FISHERY MANAGEMENT PLAN****DATED: 15 MAY 2002****Table 3-8. Market squid volume and value exported and respective rankings for 1990 through 2000 (last year data available).**

Year	Squid exported (tons)	Export value*	Rank by volume	Rank by value	Percent catch exported
1993	4,569	\$5,448,155	1	6	9.7
1994	15,801	\$15,817,174	1	3	25.8
1995	24,107	\$21,196,325	1	1	30.2
1996	36,377	\$32,802,620	1	2	41.1
1997	49,745	\$45,989,317	1	1	64.2
1998	1,554	\$2,109,087	8	20	48.7
1999	37,411	\$36,355,586	1	1	29.8
2000	92,701	\$71,637,625	1	1	75.2

\*Note: export value not adjusted for inflation.

The role of international buyers in the success of the California market squid fishery is substantial. After decades of generally low catches, volume increased during the 1990s because of new markets and higher prices. However, landings and ex-vessel revenue declined during the 1997-1998 El Niño when squid became harder to catch and as overseas markets collapsed due to poor economic conditions in Asia. Since the 1997-1998 ENSO, there has been some recovery of the Asian market, although demand is affected greatly by performance of other worldwide fisheries, particularly the Falklands *Loligo* fishery.

California's fishing industry ranks among the top five seafood producing states in the nation (CSC 1997), and growth or decline in commercial fishing, including the market squid industry, affects production, trade, and employment throughout the California economy. There are three major port areas (see Table 3-9) associated with California's commercial market squid fishing industry: central California (Monterey County); Santa Barbara port area (Ventura and Santa Barbara counties); and Los Angeles port area (Los Angeles and Orange counties). Since the 1993-1994 fishing season, the Santa Barbara and Los Angeles port areas have received the bulk of market squid revenues, with the highest revenues coming into the ports of San Pedro, Port Hueneme and Ventura (Table 3-10).

**Table 3-9. Market squid landings (in tons) by port area (N-SFO = counties north of San Francisco; SFO = San Francisco County, M/SC = Monterey and Santa Cruz counties; SLO = San Luis Obispo county; SB/VE = Santa Barbara and Ventura counties; LA/OC = Los Angeles and Orange counties; SD = San Diego County).**

Season	N-SFO	SFO	M/SC	SLO	SB/VE	LA/OC	SD	Total
1981-1982	3	<1	14,129	<1	2,287	9,413	<1	25,833
1982-1983	1	3	11,692	<1	4	1,512	<1	13,213
1983-1984	<1	509	551	<1	8	17	1	1,087
1984-1985	<1	107	442	<1	373	431	<1	1,354
1985-1986	<1	85	4,191	<1	4,657	5,442	<1	14,376

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Table 3-9. Market squid landings (in tons) by port area (N-SFO = counties north of San Francisco; SFO = San Francisco County, M/SC = Monterey and Santa Cruz counties; SLO = San Luis Obispo county; SB/VE = Santa Barbara and Ventura counties; LA/OC = Los Angeles and Orange counties; SD = San Diego County).								
Season	N-SFO	SFO	M/SC	SLO	SB/VE	LA/OC	SD	Total
1986-1987	<1	917	6,049	<1	8,884	9,749	3	25,603
1987-1988	<1	378	6,253	<1	12,703	5,878	1	25,214
1988-1989	33	330	5,402	<1	21,883	20,526	21	48,195
1989-1990	1	4	7,803	21	10,539	14,682	2	33,051
1990-1991	1	142	8,728	<1	13,201	10,400	<1	32,472
1991-1992	2	1,622	7,389	<1	18,098	11,554	0	38,666
1992-1993	<1	2,698	6,751	1	7,297	2,028	18	18,793
1993-1994	<1	1,122	6,643	2,247	25,571	18,869	<1	54,452
1994-1995	77	2,464	15,021	1,540	32,685	11,802	2	63,592
1995-1996	2	823	2,700	151	67,824	22,331	2	93,833
1996-1997	0	367	5,235	226	90,039	28,441	1	124,309
1997-1998	4	226	9,045	<1	1,593	28	2	10,898
1998-1999	<1	15	0	10	9,862	1,809	2	11,699
1999-2000	<1	6	294	8	84,818	41,637	10	126,772
2000-2001	1	<1	7,711	19	66,629	48,996	45	123,400

Table 3-10. Dollars paid ex-vessel for market squid by port area (N-SFO = counties north of San Francisco; SFO = San Francisco County, M/SC = Monterey and Santa Cruz counties; SLO = San Luis Obispo county; SB/VE = Santa Barbara and Ventura counties; LA/OC = Los Angeles and Orange counties; SD = San Diego County). *Note: Dollars not adjusted for inflation.								
Season	N-SFO	SFO	M/SC	SLO	SB/VE	LA/OC	SD	Total
1981-1982	\$1,356	\$7	\$3,267,294	\$76	\$204,494	\$1,077,934	\$0	\$4,551,162
1982-1983	\$589	\$0	\$2,293,429	\$232	\$2,390	\$430,360	\$70	\$2,727,070
1983-1984	\$76	\$82,473	\$168,579	\$125	\$8,582	\$8,927	\$143	\$268,905
1984-1985	\$39	\$14,361	\$182,824	\$130	\$122,783	\$250,193	\$25	\$570,355
1985-1986	\$13	\$792	\$1,576,035	\$171	\$819,407	\$1,277,355	\$144	\$3,673,916
1986-1987	\$199	\$91,485	\$1,277,502	\$79	\$887,039	\$1,925,881	\$1,347	\$4,183,532
1987-	\$0	\$13,539	\$997,347	\$20	\$1,095,698	\$1,096,954	\$290	\$3,203,847

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Table 3-10. Dollars paid ex-vessel for market squid by port area (N-SFO = counties north of San Francisco; SFO = San Francisco County, M/SC = Monterey and Santa Cruz counties; SLO = San Luis Obispo county; SB/VE = Santa Barbara and Ventura counties; LA/OC = Los Angeles and Orange counties; SD = San Diego County). *Note: Dollars not adjusted for inflation.								
Season	N-SFO	SFO	M/SC	SLO	SB/VE	LA/OC	SD	Total
1988								
1988-1989	\$638	\$67,909	\$1,147,454	\$56	\$355,255	\$3,296,624	\$8,277	\$4,876,212
1989-1990	\$366	\$1,079	\$1,148,961	\$107	\$188,955	\$1,613,259	\$1,106	\$2,953,832
1990-1991	\$144	\$30,691	\$1,299,765	\$59	\$1,223,192	\$1,343,869	\$643	\$3,898,362
1991-1992	\$1,452	\$344,122	\$873,987	\$51	\$830,200	\$1,137,595	\$0	\$3,187,407
1992-1993	\$40	\$452,087	\$652,164	\$163	\$764,033	\$444,441	\$3,612	\$2,316,541
1993-1994	\$6	\$320,948	\$1,012,803	\$505,792	\$2,612,486	\$2,923,770	\$0	\$7,375,804
1994-1995	\$17,477	\$633,318	\$2,807,522	\$453,583	\$8,149,029	\$2,607,151	\$306	\$14,668,386
1995-1996	\$463	\$214,959	\$432,174	\$21,301	\$13,432,243	\$5,544,538	\$50	\$19,645,729
1996-1997	\$0	\$12,160	\$521,737	\$58,681	\$14,810,588	\$8,354,422	\$262	\$23,757,850
1997-1998	\$2,180	\$60,241	\$2,136,685	\$10	\$429,861	\$19,499	\$525	\$2,649,001
1998-1999	\$0	\$15,161	\$0	\$621	\$4,299,327	\$859,916	\$1,269	\$5,176,294
1999-2000	\$6	\$1,774	\$78,576	\$4,024	\$24,819,984	\$11,111,792	\$7,000	\$36,023,155
2000-2001	\$16	\$0	\$1,881,719	\$1,912	\$11,809,626	\$10,816,031	\$22,683	\$24,531,987

The three port areas where squid is most commonly landed are Monterey Bay, Santa Barbara port area (Port Hueneme and Ventura) and Los Angeles port area (San Pedro and Terminal Island). Since the 1981-1982 season, these three areas account for an average of 98% of all squid landings except during El Nino periods (1982-1983 - 53% and 1992-1993 - 86%) when squid landings were minimal. Based on landings, other ports landing squid are of minor economic importance (Table 3-10).

In general, ex-vessel revenues have closely paralleled landings until the 2000-2001 season when dollars paid ex-vessel clearly dropped (Figure 3-5). Although the volume of squid produced by California markets is dependent on the international market, the price paid to fishermen can influence both effort and overall volume of catch. Additionally, price paid to fishermen depends on market demand as well as the availability of the resource. When volume of catch is low, the price paid per ton is high, exceeding \$500 per ton during the 1997-1998 El Niño. When volume is high, the price is driven down to as low as \$100 per ton. Squid taken by brail, and in small volumes tends to receive a better price. Oftentimes, the price of fish will start high at the beginning of the season in



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November, and decline as the frozen product begins to accumulate in cold storage facilities. Consequently, there is often less incentive for fishermen to fish later in the season, and as a result, declines in landings for springtime months may not just reflect a reduction in the availability of squid, but also a lack of effort. Additionally, many vessels participating in summer salmon fisheries will return to other ports during spring months.

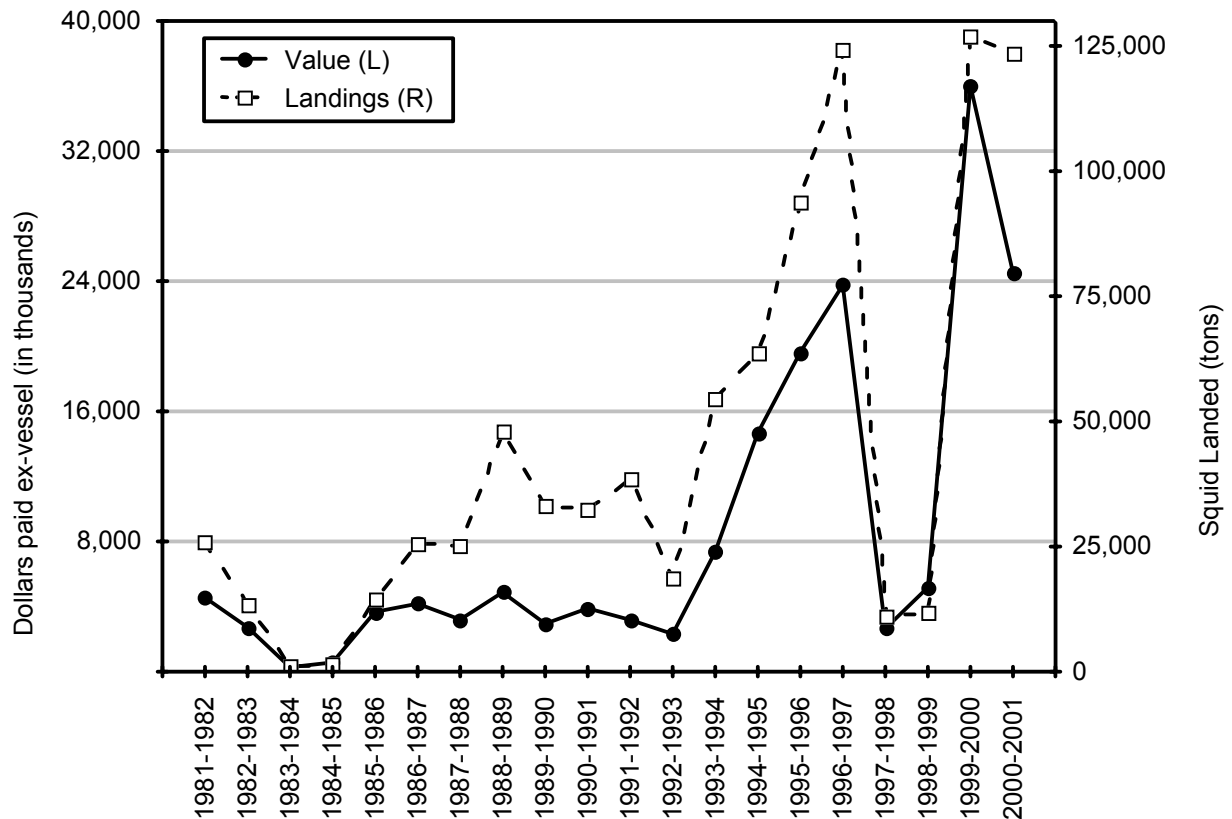


Figure 3-5. Dollars paid ex-vessel and landings in tons for the 1981-1982 through 2000-2001 seasons.

California markets play a role in determining the composition of the market squid fleet. Although there are many California vessels that have historically participated in the fishery that are still active, there is an increasing proportion of fishery participants from Alaska, Washington and Oregon, reflecting a willingness of the markets to employ these vessels.

Most of this revenue is generated by the purse seine fishermen who dominate the fishery landings (Table 3-11). Drum seine vessels have been increasing their revenues steadily since the 1994-1995 season, except during El Nino periods. Revenue from squid fishing using lampara nets has declined 99% from 2.7 million dollars in 1981-1982 to \$27,000 in the 2000-2001 season. These

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changes in revenue by gear type reflect the changes in the fleet for these vessels which have switched to using purse seine nets.

Table 3-11. Dollars paid ex-vessel by gear type for market squid fishery from 1981-1982 to 2000-2001 seasons. Note: dollars are not adjusted for inflation.						
Season	Brail	Purse seine	Drum seine	Lampara	Other	Total Value
1981-1982	\$784,085	\$485,689		\$2,736,398	\$544,990	\$4,551,162
1982-1983	\$220,933	\$232,256		\$2,256,622	\$17,260	\$2,727,070
1983-1984	\$9,884	\$1,973		\$88,548	\$168,499	\$268,905
1984-1985	\$313,559	\$26,941		\$37,497	\$192,358	\$570,355
1985-1986	\$22,772	\$1,836,397		\$755,088	\$1,059,659	\$3,673,915
1986-1987	\$46,771	\$2,208,225		\$819,332	\$1,109,205	\$4,183,532
1987-1988	\$30,728	\$1,831,687		\$473,646	\$867,786	\$3,203,847
1988-1989	\$25,106	\$2,621,290	\$10,924	\$956,279	\$1,262,613	\$4,876,212
1989-1990	\$16,809	\$1,792,182	\$23,630	\$168,002	\$953,209	\$2,953,832
1990-1991	\$12,810	\$2,576,712		\$109,038	\$1,199,802	\$3,898,362
1991-1992	\$5,218	\$2,243,108	\$2,118	\$12,063	\$924,899	\$3,187,407
1992-1993	\$5,808	\$2,080,155		\$22,029	\$208,549	\$2,316,541
1993-1994	\$68,758	\$6,611,752	\$441,568	\$1,811	\$251,916	\$7,375,804
1994-1995	\$280,832	\$8,181,704	\$5,857,551	\$9,658	\$338,642	\$14,668,386
1995-1996	\$213,986	\$12,327,482	\$6,912,266	\$45,053	\$146,942	\$19,645,729
1996-1997	\$109,399	\$16,506,397	\$6,901,917	\$28,358	\$211,777	\$23,757,850
1997-1998	\$17,566	\$1,752,117	\$870,181		\$9,137	\$2,649,001
1998-1999	\$102,152	\$3,557,620	\$1,510,022		\$6,500	\$5,176,294
1999-2000	\$260,915	\$27,755,093	\$7,911,879	\$37,693	\$57,575	\$36,023,155
2000-2001	\$508,708	\$18,493,398	\$5,446,843	\$27,043	\$55,995	\$24,531,987
Total	\$3,056,798	\$113,122,176	\$35,888,899	\$8,584,159	\$9,587,315	\$170,239,346

An annual average of 114 fishing vessels participate seasonally in the market squid fishery. The average roundhaul vessel has a crew size of 7.2 (range 4-10). Crew wages are typically 50% of ex-vessel revenue after operating costs. Light boats are paid 20% of the catch value after costs (Lutz and Pendleton, 2001).

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Usually, there is a 1:1 ratio of light boats to seiners on the fishing grounds (O. Amoroso, pers. comm.).

From 1981-1982 through 2000-2001, an average of 54 dealers received market squid from fishing vessels each season. On the other hand, 444 different dealers received market squid during that time span. In the early 1980s, dealers in the Monterey port area received the majority of the squid business (Table 3-12). This trend has shifted south to the Santa Barbara/Ventura port area complex which has received, on average, 55% of market squid business in the last five years.

Table 3-12. Percent of revenue received by port area complex from 1981-1982 through 2000-2001 fishing seasons. Note: dollars were not adjusted for inflation.				
Season	Monterey Area	Santa Barbara/Ventura	Los Angeles	Other Areas
1981-1982	71.8	4.5	23.7	0.0
1982-1983	84.1	0.1	15.8	0.0
1983-1984	62.7	3.2	3.3	30.8
1984-1985	32.1	21.5	43.9	2.6
1985-1986	42.9	22.3	34.8	0.0
1986-1987	30.5	21.2	46.0	2.2
1987-1988	31.1	34.2	34.2	0.4
1988-1989	23.5	7.3	67.6	1.6
1989-1990	38.9	6.4	54.6	0.1
1990-1991	33.3	31.4	34.5	0.8
1991-1992	27.4	26.0	35.7	10.8
1992-1993	28.2	33.0	19.2	19.7
1993-1994	13.7	35.4	39.6	11.2
1994-1995	19.1	55.6	17.8	7.5
1995-1996	2.2	68.4	28.2	1.2
1996-1997	2.2	62.3	35.2	0.3
1997-1998	80.7	16.2	0.7	2.4
1998-1999	0.0	83.1	16.6	0.3
1999-2000	0.2	68.9	30.8	0.0
2000-2001	7.7	48.1	44.1	0.1

Demographics

The primary locations for commercial market squid are Monterey, Santa Barbara, Ventura, and Los Angeles counties. The following demographic information was available for these areas.

Monterey County

The population of Monterey County was approximately 365,000 in 1997 and 33,000 in the City of Monterey. The city of Monterey is 8.62 square miles. Monterey County has three main economic focuses: Agriculture, Tourism and Military. Agriculture takes place mainly in the Salinas Valley. It is the stronghold of the Monterey County economy. In 1995, 30% of the counties labor and proprietor income was from agriculture. Tourism activity is concentrated along

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the coastal areas. The military has the Naval Postgraduate School and the Defense Language Institute in the city of Monterey. The downsizing in the military included Fort Ord in Monterey County. The downsizing began in 1993 and 13,000 soldiers and their families were relocated. The community is working to replace the military industrial sector with an education sector (PFMC 2001). Beginning in 1930, Monterey supported a thriving fishing industry at Cannery Row. Today, a small commercial fleet and industry operates at Monterey Bay marinas.

Santa Barbara County

The population of Santa Barbara County increased from 369,608 in 1990 to 399,347 in 2000. The average annual wage in Santa Barbara County in 1998 was \$29,277, while the average commercial fishing wage was \$27,061 (CTTCA 2000).

Agriculture accounted for 11% of Santa Barbara's total income in 1997. In 1999, manufacturing overtook agriculture as the most important contributor to the economy of Santa Barbara County. Non-agricultural income from health care and social assistance, retail trade, professional, scientific and technical services, and construction followed manufacturing in terms of importance (PFMC 2001).

Ventura County

Similar to Santa Barbara, agriculture accounted for 9% of the county's labor and proprietor income but was overtaken by manufacturing in 1999. Again, manufacturing was followed by other sources of non-agricultural income: retail trade, wholesale trade, health care and social assistance, and finance and insurance sectors( PFMC 2001).

Port Hueneme is located in Ventura County and was created to provide an ocean link from the California central coast agricultural community to global markets (PFMC, 2001). Port Hueneme is the U.S. port of entry for the central coast area of California and is the only deep water harbor between Los Angeles and San Francisco harbors. It ranks among the top seaports in California for general cargo. Port Hueneme specialized in the import and export of automobiles, heavy agricultural equipment and industrial vehicles, fresh fruit and produce, forest products, and project cargo. Port Hueneme ranks as the top seaport in the United States for citrus export. It ranks among the top ten seaports for automobile and banana imports. Over \$4 billion in cargo value moves through Port Hueneme annually. The port provides space for local sport and commercial fishing industries and related activities generate over \$388 million for the local economy each year and 3,500 jobs in Ventura County are directly or indirectly related to operations at Port Hueneme (PFMC 2001).

Los Angeles County

The population of Los Angeles County increased from 8,863,000 to 9,519,338 between 1990 and 2000. The economy of Los Angeles County is diverse. In

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1996, the number of employees in the country was over 4 million. In 1998, the average annual wage in Los Angeles County was \$36,000, while the average commercial fishing wage was \$22,617 (CTTCA 2000).

Community profile - San Pedro

San Pedro, located in southwest Los Angeles on the southeastern slope of the Palos Verdes Peninsula. The community's roots developed over a century of participation in fishing and related industries and are described in the San Pedro Community Environmental Perspectives (1989). The community is relatively small, with a hometown feeling, enhanced by the fact that many residents are locally employed.

During the 1980s, the commercial fishing industry in Los Angeles continued to decline, directly affecting the local economies of San Pedro and Wilmington. One reason for the decline was price-cutting competition from foreign fisheries, which allegedly operated with lower labor costs and government subsidies. State and local taxes and high insurance costs were blamed as additional burdens on the struggling industry. By 1986, only one fish packing plant remained of the fourteen that operated in 1960 (PFMC 1998).

The population in San Pedro decreased from 85,987 in 1990 to 84,697 in 2001. In 1996, 51.6% of the community was Caucasian, 33.8% was Hispanic, 6.2% was African American, and 7.6% was Asian. The average per capita income in 1996 was \$19,413 (Claritas 1996).

**3.2.2.2 Recreational Fishing Effort**

There are not sufficient data to describe recreational fishing effort for market squid.

**3.2.3 Fishery Impacts**

The adverse effects from fishing activities may include physical, chemical, and biological alterations of the substrate, and loss of, or injury to benthic organisms, prey species and their habitat, and other components of the ecosystem. FMPs must include management measures that minimize adverse effects on marine ecosystems from fishing, to the extent practicable, and identify conservation and enhancement measures. They must also contain an assessment of the potential adverse effects of all fishing activities and should consider the relative impacts of all fishing equipment used in varying habitats (Bargmann et. al. 1998).

Fishing for market squid could have important trophic implications and other ecological concerns (see Chapter 7). In the commercial fishery, some have voiced concern over the use of chains as a seine weight and would like to see an alternative, such as a lead line. Chains have the potential of digging deeper into the ocean floor than the suggested alternative (Hastings and MacWilliams 1999).

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Net bottoms may also scrape the ocean floor and harm squid eggs. A suggestion was made for a maximum depth and length of net to avoid disturbance to egg cases. There is also concern for squid caught which have not yet spawned. Bycatch is minimal in the commercial fishery, although it cannot be avoided entirely. According to squid vessel logbooks, bycatch consists mainly of other pelagic species (Pacific sardine, Pacific mackerel, jack mackerel, and northern anchovy) and less often, bat rays. Port sampler observations agree with the logbook data.